



**S N BOSE NATIONAL CENTRE
FOR BASIC SCIENCES**

Block JD, Sector III, Salt Lake, Kolkata 700 106

DEPARTMENTAL SEMINAR

Condensed Matter and Materials Physics

06th December, 2023

4.00 PM

ONLINE/FERMION

SPEAKER

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TITLE OF THE TALK

SCALABLE 2D HETEROSTRUCTURES FOR QUANTUM OPTOELECTRONICS

ABSTRACT

The miniaturization of electronic components demand efficient multifunctional devices in the ultra-thin regime. This calls for a revolution in the materials and device engineering. In this context, two-dimensional (2D) materials have shown tremendous promise, offering thousands of fascinating atomically thin functional materials, including semimetals, semiconductors, insulators, magnets, and superconductors. These can be seamlessly integrated in preferential order and twisted angle into 2D heterostructure to harvest desired functionalities such as Moiré excitons, many-body correlation in twisted layers, and entangled quantum emission, surpassing the capabilities of traditional materials. This enables highly sensitive-miniaturized (opto)electronic devices, which have widespread applications in our daily lives, including 5G telecommunication, computing, 3D imaging, Internet of Things, wearable biomedical sensors, and display technology. Despite this urgent need, scalable preparation of 2D materials of the desired thickness has remained challenging. Importantly, 2D architectures behave as artificial crystals rather than independent layers for hybridizing their individual properties to yield new functionality. This process requires the pristine quality of the materials of specific layer number and great control over twisting angles between layers with interfaces free from impurities such as bubbles, blisters, wrinkles, and folds, which has proven extremely challenging to control simultaneously. In this talk, I will showcase recent activities in my group, showing the current state-of-the-art 2D heterostructures and present a new route from synthesizing ultra-large area single crystalline 2D layers, which can potentially address those challenges.

HOST FACULTY

Dr. Saquib Shamim, Assistant Professor
